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ABSTRACT

Lorain County Community College (LCCC) has provided training programs for the employees of the United States Steel Corporation since 1969 and for the Lorain Telephone Company since 1977. These training programs are campus-based, and the students attend classes for four or five week periods at a time. An effort has been made to adhere-as closely as possible to the regular class pattern of the college in order to integrate the trainees into the regular student body and minimize program visibility on campus. Program content is based on the occupational training needs determined by college representatives and company training officials. Currently, there are four trade areas involved: Basic Telephony, Electrical Skills, Mobile Equipment Repair, and Millwright. Several other trade areas have been serviced at times. The curriculum, which is common to all students, is based upon a "building block" approach that helps alleviate problems of scheduling, student alienation and stress, and finding skilled instructors. The instructors are part-time, temporarily employed specialists in the various trade skill areas. Because of the unique nature of the apprentice groups, there were some problems early in the program. Some of these necessitated the clarification of college/union relationships. An appendix contains course schedules, outlines, and syllabi, and the report describes program costs and administrative structures. (DR)

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SPECIALIZED APPRENTICE-LEVEL TRAINING PROGRAMS FOR INDUSTRY

By

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JC 790 397

Paper presented at the International Institute on the Community College (9th, Sarnia, Ontario, June 12-15, 1978)

SPECIALIZED APPRENTICE-LEVEL TRAINING PROGRAMS FOR INDUSTRY

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SPECIALIZED APPRENTICE-LEVEL TRAINING PROGRAMS FOR INDUSTRY

History and Background

In 1969 the United States Steel Corporation and Lorain County Community College entered into discussions about the need for specially tailored training programs for apprentices. Due to the specialized technology and equipment used in the steel industry and the unique demands placed upon the skilled trades in steel plants, conventional apprentice programs were inadequate to provide the amount and type of training desired.

The program which was developed provided for the classroom or "related" content to be taught on the College campus on a schedule alternating with the work schedule of the students who are full-time, permanent employees of the U. S. Steel Corporation. The College is not involved in the work phases of the program and no formal credit is associated with the work experience.

Since the inception of the program, nearly six hundred apprentices in eleven different trade categories have completed the program. The success and continued development of the program have been enhanced by the cooperative efforts of the Corporation training executives, the union leadership and the involved staff of the College.

In 1977 development of a very similar program was undertaken for the Lorain Telephone Company for service and technical trainees. An initial group of students were accepted into this program late in 1977.

Program Organization

The training programs provided by the College are campus based, and the students attend classes for periods of four weeks at a time. Two groups of students alternate in the program with one group assigned to the plant while the other is on the campus.

U. S. Steel students attend classes on a forty-hour per week basis and are paid their regular wage during the training periods on campus. Time reports are kept by each instructor and are submitted regularly to the Corporation for payroll purposes. During the instructional program, the instructor is considered to be the students' supervisor, and they are responsible to him in the same way as they are to regular supervisors at the Corporation.

Lorain Telephone students attend two eight-hour days per week for a period of five weeks. Otherwise, the program for the Telephone Company is similar to that for U. S. Steel.

While special programs of this type can be scheduled at any time on the campus, an effort is made to adhere as closely as possible to the regular class pattern of the College. This practice was instituted as part of the effort to integrate the trainees into the regular student body and to reduce the tendency for them to be conspicuous and self-conscious. Insofar as possible, classes are scheduled to begin on the hour and break at ten minutes before the hour with the first class beginning at 8:00 a. m. Laboratories or class sessions scheduled to run for two or more hours may be interrupted at the instructor's discretion; however, breaks are encouraged at the regular times, ten minutes before the hour, to reduce disturbances to other classes in session.

Training programs are assigned second priority for classroom and laboratory scheduling and may utilize any facilities after regular credit classes are accommodated. These programs fall essentially in the same category as non-credit, special interest and other continuing education offerings, but are given higher scheduling priority because of the greater structure and advance scheduling needs.

The programs are administered by the Community Education division but are located with the Division of Engineering Technologies since the bulk of the program contents relate closely to the Engineering Technologies Division and its facilities. The program coordinator is a twelve-month administrative employee whose primary duties include teaching, scheduling, staffing and curriculum development as well as daily supervision of the ongoing programs (see complete job description in appendix).

To establish billing rates to the companies, the programs are each budgeted as separate auxiliary enterprises, and the following individual line items are identified as direct expense categories.

Salaries - Administration
Salaries - Part-time
Salaries - Academic/Overload
Salaries - Faculty/Part-time
Retirement Contributions
Workmen's Compensation
Unemployment Compensation
Group Life Insurance
Health Insurance
Major Medical Insurance
Instructional Supplies
Central Services Supplies
Conferences/Committees
Local Reimbursable Travel
Printing/Binding - Central Services
Xerographic Copying - In-house
Telephone Allocation
Postage/Freight - Central Services
Miscellaneous Other

In effect the companies are billed at a rate sufficient to cover the actual expenses in their categories, but are not charged for other administrative or campus overhead. The justification for this practice is that some additional monies are received from a local tax levy (which the companies pay) and from the State Department of Education as adult, continuing-education reimbursement for the trainees. As a matter of Board policy, these monies are credited to the General Fund and the companies are billed only for the variable cost of the programs.

Current charges to the companies average about $260.00 per student for a four-week (160 hour) term, or an average of $1.63 per student hour.

Total cost models for all programs at the College are under development, and a re-examination of trainee programs will also be made to determine if charges to the companies are adequate to cover assignable costs. However, no large adjustments are anticipated.

Curriculum

The content of the programs are entirely based upon the need of the trainee occupational areas and are not constrained by any externally imposed requirements. The curricula were developed by mutual agreement between the College representatives and company training officials. As outline and syllabi are developed and implemented, a process of review is provided in which instructors, company officials, union representatives and current and former students have the opportunity to suggest changes in the curriculum. Modifications are possible on short notice since no approval process is required beyond concensus between the College and the Company. Because of the great flexibility, alterations may be implemented for individual groups of students to suit special needs in their work or to adjust to special deficiencies in student background on preparation.

At the present time there are four different trade or occupational areas involved in the program including:

Basic Telephony
Electrical
Mobile Equipment Repair
Millwright

In addition, several other trade categories have been serviced at various times, including:

Machinists
Pipefitters
Boilermakers
Riggers

The subject titles included in each program and the time schedule followed are given in the appendix. It may be noted that certain subjects are common to more than one program, and students may be intermingled in some classes.

This curricular arrangement is obviously more typical of College programs of study and does not follow the vocational model of study in which basic material and applied material are integrated, often under one instructor meeting the students continuously. While the latter arrangement has some advantages, the building block

approach offers several over-riding advantages for these programs, including:

1. Scheduling of rooms, labs, etc., can be worked in among the regular credit classes at the College.

2. Students melt into the campus flow in an inconspicuous manner which has been found to be very important.

3. Spending forty hours per week in school is demanding upon active adults and the opportunity to vary location, instructors, and material helps maintain interest.

4. Specialized instructors may be used in various subjects. It is very difficult to find instructors who have maximum proficiency in a variety of material categories.

Since apprentice students are recruited from a variety of backgrounds, the level of preparation varies greatly, especially in mathematics. To accommodate students with stronger backgrounds, an advanced math section was devised, and students are placed in regular or advanced math following an examination at the start of the program. The remainder of the curriculum is common to all students; and therefore the level of math demanded in the trade courses is adjusted to match the regular math requirement.

While other topics might be substituted instead of advanced math, this approach is preferred since all students must be provided the same trade skills. More math serves to motivate the better prepared students by developing their ability to deal with trade problems more easily or with specialized techniques.

All participants in these programs are employees of the respective companies and attend the training by virtue of their employment as an apprentice. All students, therefore, have met the requirements for employment by the company and are not subjected to any further academic or aptitude screening. Testing is used only to establish levels of proficiency, especially in math, for the purpose of assignment to the proper level of instruction.

Most of the instruction is done by part-time, temporary, specialists in the various trade and technical skill areas. Full-time

faculty members of the Technology departments are utilized if they are interested and if they can provide instruction in an appropriate specialty.

Experience and knowledge in the specialty are the prime requisites for instructors. There are no formal requirements for teaching credentials; however, a display of teaching ability is expected if the individual is to be continued in the program. Prime sources of instructors include individuals who are retired or who are working shifts which enable them to teach at selected hours.

Finding qualified instructors requires constant effort. The most common source is among retired supervisors and journeymen from the respective trades. Retired school teachers are also used for the academic subjects such as math, physics or communication.

The other most common source is the large cadre of employed journeymen and supervisors in the area who work shifts that don't conflict with class times.

For classes to be funded by the Ohio State Department of Education, instructors must meet adult vocational education standards consisting of these alternatives: Seven years in the trade, plus high school graduation or five years in the trade plus a Bachelor's degree or certification in vocational education.

While instructor recruiting requires constant attention, qualified individuals who have been very effective in the programs have been located.

Inter-relationships Between the Programs and the College

As a result of the unique nature of the apprentice student groups and the fact that they follow a curriculum distinguished from regular courses, there were some problems early in the program. These difficulties stemmed from behavioral and attitudinal characteristics which varied from those of the traditional college students. The apprentice students, being on the company payroll, are more regimented in the sense of attendance requirements and pressure to succeed academically since failure would result in them being reassigned to less desire-

able programs. They felt that they were discriminated against and did not have the same privileges as other students. These feelings led to some antagonisms and antisocial behavior which attracted negative responses from other students and eventually the student senate.

To improve the situation, an effort was made to flow the students into the mainstream of the College totally and reduce the visibility of the program as something unusual or different. Steps taken included:

1. Scheduling the program to match regular class times and starting times (apprentices originally attended at times matching the 7:00 a.m. to 3:30 p.m. work shift.)

2. Emphasizing that apprentices are regular students and encouraging them to participate in student activities and to use all campus facilities.

3. Explaining the College code of conduct during orientation and giving a copy to each student.

4. Enforcing rules uniformly and consistently with total support from both the company and the union.

5. Providing the apprentices an effective channel of communication to air and react to concerns.

Within a short time after implementing these practices, the problems largely disappeared and have been of little concern for several years.

Since the apprentices are on the company payroll, they are union members, a fact which adds an additional dimension to the total relationship. Students, for example, may file grievances relating to the time they spend on the campus in the program; however this has been a very infrequent occurance since the students have been provided with channels of communication within the College. In addition, strong support for the program within the union leadership has discouraged trivial complaints. Where grievances have been filed, the College is not involved in the process except as required to provide information.

The program has proved to be a success both for the companies, who obtain specialized training for employees at a cost below that possible in-house, and for the College, which has found that several of the apprentices evenutally continue taking courses on their own beyond the program.

APPENDIX

PROCEDURE

COORDINATOR - APPRENTICE PROGRAM

Job Description

The Coordinator of Apprentice Training has direct line responsibility to the Chairperson, Division of Engineering Technologies. The Coordinator is responsible for developing and conducting the apprentice training program. He shall develop curricula, schedule classes, provide supervisory services, recruit and recommend new instructors for the program. In addition to these general responsibilities, he will:

A. Teach assigned sections of the program.

B. Coordinate room scheduling.

C. Prepare and recommend through the Chairperson an operating budget.

D. Develop future programs.

E. Collect, and process such records and reports as are required by the program.

F. Arrange for coverage of classes in the event of instructor absence.

G. Review and requisition new material that could be used in the program.

H. Inventory, inspect and repair or replace textbooks.

I. Prepare billing information monthly.

J. Insure that the handling of any illness or injury of the student is handled in accordance to the policy of the client company.

K. Orient new instructors to the mechanics of the program and assist them in obtaining and organizing their teaching materials.

L Collect, develop and maintain detailed records of curriculum, course contents, and syllabi.

M. Assist the Division Chairperson in organizing and implementing an instructor training program on a regular basis.

N. Arrange student placement during holidays.

O. Maintain close liaison with students in the program.

PROCEDURE

COORDINATOR - APPRENTICE PROGRAM

P. Communicate regularly with the Division Chairperson and representatives of the client company regarding any policy or operating procedure which may require their attention.

Q. Oversee daily activities of program to insure continuity, harmony, and achievement of goals during the hours the students are on campus.

R. Perform other duties as assigned or delegated by the Chairperson of the Division of Engineering Technologies.

United States Steel

ELECTRICAL

REGULAR MATH

Phase I

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00	D.C. CIRCUITS ET 118 Polesko	D.C. CIRCUITS ET 112 Polesko	ELECTRICITY ET 118 Wheeler	D.C. CIRCUITS ET 112 Polesko	ELECTRICITY ET 118 Wheeler
9:00					
10:00	NAT. ELECTRIC CODE ET 106 Polesko	MATH PS 104 Filipiak	SCHEMATICS ET 106 Essex	MATH PS 104 Filipiak	D.C. CIRCUITS ET 110 Polesko
11:00	MATH PS 114 Filipiak	SAFETY PS 108	MATH PS 114 Filipiak	ELECTRICITY ET 117 Wheeler	NAT. ELECTRIC CODE ET 113 Polesko
12:30	LUNCH				
1:00	PHYSICS PS 114 Bidwell	PHYSICS ET 116 Bidwell	ELECTRONICS ET 106 Essex	SCHEMATICS ET 111 Essex	TECH. REPORT PS 202 Ramsdell
2:00	ELECTRONICS ET 110 Essex	ELECTRONICS ET 111 Essex	PHYSICS PS 112 Bidwell	ELECTRONICS ET 118 Essex	ELECTRONICS ET 110 Essex
3:00					
4:30					

United States Steel

ELECTRICAL PROGRAM
Phase I (4 weeks)

D. C. Circuits I (7 hrs/wk)

Voltage sources; Ohms Law; series, parallel and series - parallel circuits; power; resistance and conductance.

Electricity I (6½ hrs/wk)

Atomic theory, static electricity, theory of magnetism, and electro magnetism.

Electronics I (11 hrs/wk)

Basic D. C. theory, circuits, and application. Magnetism and magnets. Ohms and Kirchoff's Laws. Care and use of test equipment.

Industrial Safety I (1½ hrs/wk)

Guest speakers from U. S. Steel present topical safety programs.

Math I (5 hrs/wk)

Advanced and regular sections of arithmetic and metrics.

National Electric Code I (2½ hrs/wk)

Definition of terms; requirements for electrical installations, grounded conductors; branch circuits; feeders, and services.

Physics I (3 hrs/wk)

Fundamentals. Solids, liquids, and gases; forces, balance and gravitation.

Schematics I (1½ hrs/wk)

Standard symbols and elementary wiring diagrams.

Technical Reporting I (2 hrs/wk)

Basic oral and written communications.

United States Steel

ELECTRICAL PROGRAM
Phase II (4 weeks)

A. C. Circuits I (9 hrs/wk)

A. C. waveforms, resistive circuits, inductors and transformers.

Electricity II (5 hrs/wk)

Capacitors and inductors. LCR power circuits.

Electronics II (11 hrs/wk)

Basic A. C. Theory, circuits and application. Transformers. Inductance and capacitance.

Industrial Safety II (1½ hrs/wk)

Guest speakers from U. S. Steel present topical safety programs.

Math II (5 hrs/wk)

Advanced and regular sections of algebra.

National Electric Code II (2½ hrs/wk)

Services, overcurrent protection and grounding.

Physics III (3 hrs/wk)

Application of electricity to machines and lighting. Electro-chemical sources of electricity. Generation, transmission and distribution of electricity. Heat energy and heat machines.

Schematics II (1 hr/wk)

Diagramming circuits and simple controls.

Technical Reporting II (2 hrs/wk)

Research and writing of job procedures as they apply to preventive maintenance.

ELECTRICAL PROGRAM
Phase III (4 weeks)

Blueprint Reading I (1½ hrs/wk)

Alphabet of lines, orthographic drawings, dimensions, and notes.

D.C. Controls I (8 hrs/wk)

Types of controls and troubleshooting.

D.C. Motors I (5 hrs/wk)

Construction, characteristics, and application of D.C. series, shunt, and compound motors and generators.

Electronics III (11½ hrs/wk)

RC, LR, and LCR circuits. Resonance. Impedance matching. Wheatstone bridge, wattmeter and strain gages. Power sources.

Hydraulics V (3½ hrs/wk)

Basic hydraulic fundamentals and circuits.

Math III (4½ hrs/wk)

Advanced and regular sections of geometry.

Schematics III (1½ hrs/wk)

Reading and drawing D.C. control circuits.

Shop Sketching I (3½ hrs/wk)

Sketching straight and curved lines, irregular shapes and fillets. Freehand lettering. Orthographic sketching.

Trade Topics III (1 hr/wk)

Discussion of specific in-plant problems encountered by the apprentice electrician.

ELECTRICAL PROGRAM
Phase IV (4 weeks)

Electronics IV (12 hrs/wk)

Transistor theory. Diodes, Silicon Controlled Rectifiers, Diac, Triac, FET, C-MOS, & IC's. Binary coded decimal, computer principles, digital process control, control systems and zener diodes.

Mechanics I (3 hrs/wk)

Proper and safe use of tools in the mechanical work normally performed by electricians.

A.C. Controls I (11 hrs/wk)

Starters and controllers - single and polyphase.

A.C. Motors I (6 hrs/wk)

Construction, characteristics, and application of A.C. single phase and polyphase motors and generators.

Hydraulics VI (2 hrs/wk)

Hydraulic valves: functions and wiring into electrical circuits.

Shop Sketching (2 hrs/wk)

Freehand lettering. Isometric, oblique and perspective sketching.

Math IV (4 hrs/wk)

Advanced and regular sections of trigonometry.

United States Steel

MECHANICAL

REGULAR MATH

Phase I

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00	SHOP SKETCH ET 122 Bidwell	SHOP SKETCH ET 122 Bidwell	MECHANISMS ET 115 Fenton	COUPLINGS ET 108 Fenton	MATERIALS ET 112 Fenton
10:00	SHOP PRACTICES ET 105 Leonard	MATH PS 104 Filipiak	COUPLINGS ET 108 Fenton	MATH PS 104 Filipiak	COUPLINGS ET 108 Fenton
11:00	MATH PS 114 Filipiak	SAFETY PS 108	MATH PS 114 Filipiak	MATERIALS ET 113 Fenton	HYDRAULICS ET 108 Ramsdell
12:30	LUNCH				
1:00	RIGGING ET 108 Kaye	SHOP PRACT. ET 113 Leonard	TECH. REPORT ST 202 Ramsdell	COUPLINGS ET 116 Fenton	RIGGING ET 115 Kaye
2:00				HYDRAULICS ET 108 Ramsdell	
3:00	BLUEPRINT READING ET 122 Bidwell	PHYSICS ET 115 Bidwell	HYDRAULICS ET 108 Ramsdell		PHYSICS PS 114 Bidwell
4:30					

United States Steel

MOBILE EQUIPMENT REPAIR
PROGRAM
Phase I (4 weeks)

Automotive Suspension System I (1½ hrs/wk)

Front and rear systems. Shock absorber operation and service. Diagnosing suspension problems.

D.C. Circuits I (7 hrs/wk)

Voltage sources; Ohms Law; series, parallel and series-parallel circuits; power; resistance and conductance.

Hydraulics I (5 hrs/wk)

Basics of fluid power, hydraulic fluids, power units, storage reservoirs, and power lines.

Industrial Safety I (1½ hrs/wk)

Guest speakers from U.S. Steel present topical safety programs.

Materials I (3½ hrs/wk)

Crystalline structure of metals. Definition and measurement of properties. Steelmaking processes.

Math I (5 hrs/wk)

Advanced and regular sections of arithmetic and metrics.

Mechanisms I (3 hrs/wk)

Belts and pulleys.

Physics I (3 hrs/wk)

Fundamentals. Solids, liquids and gases; forces, balance, and gravitation.

Rigging I (4 hrs/wk)

Ropes, chains, hooks, and slings. Theory of knots, scaffolds. Accident prevention.

Schematics I (1½ hrs/wk)

Standard symbols and elementary wiring diagrams.

Shop Practices I (3 hrs/wk)

Use and care of hand tools.

Technical Reporting I (2 hrs/wk)

Basic oral and written communications.

United States Steel

MOBILE EQUIPMENT REPAIR PROGRAM
Phase III (4 weeks)

Automotive Electrical I (3 hrs/wk)

Servicing and charging batteries. Operation and repair of ignition system components.

Automotive Fuel Systems I (3 hrs/wk)

Principles of gasoline engines. Fuel systems. Fuel pump and carburetor fundamentals. Exhaust and emission control systems.

Automotive Steering Systems I (3 hrs/wk)

Wheel alignment and steering systems.

Bearing I (4 hrs/wk)

Types, applications and maintenance

D.C. Motors I (5 hrs/wk)

Construction, characteristics and application of D.C. series, shunt and compound motors and generators.

Hydraulics III (5 hrs/wk)

Flow control and direction control valves. Hydraulic circuits.

Math III (4½ hrs/wk)

Advanced and regular sections of geometry

Mechanisms III (4 hrs/wk)

Gears and gear trains

Pumps I (3 hrs/wk)

Centrifugal, reciprocating rotary and special application pumps.

Schematics III (1½ hrs/wk)

Reading and drawing D.C. control circuits

Shop Practices III (4 hrs/wk)

Material cutting and removal. Sanding, drilling, filing, sawing, grinding, and abrasives.

United States Steel

MOBILE EQUIPMENT REPAIR PROGRAM
Phase II (4 weeks)

Automotive Drives I (3 hrs/wk)

Types and construction of clutches. Drive lines, rear axles, and differentials. General overview of transmissions.

Blueprint Reading II (2 hrs/wk)

Tolerances, screw threads, tapes, finishes, and notes. Sections. Metric and international systems. Bills of material.

Fasteners I (2 hrs/wk)

Types, specifications and uses.

Hydraulics II (5 hrs/wk)

Control of hydraulic energy, actuators, check valves, accumulators and cylinders.

Industrial Safety II (1½ hrs/wk)

Guest speakers from U.S. Steel present topical safety programs.

Materials II (3½ hrs/wk)

Characteristics of irons and steels, forces in steel structures and forces in joints.

Math II (5 hrs/wk)

Advanced and regular sections of algebra.

Mechanisms II (3 hrs/wk)

Chains and sprockets

Physics II (3 hrs/wk)

Levers, inclined plane, wheel and screw threads. Simple and compound gear trains and machines. Fluids at rest and in motion. Atmospheric pressure.

Schematics II (1 hr/wk)

Diagramming circuits and simple controls.

Seals and Packing I (3 hrs/wk)

Materials, construction, installation and operation.

Shop Practices II (2½ hrs/wk)

Measurements, tolerances and fits.

Shop Sketching II (4 hrs/wk)

Freehand lettering, Isometric, oblique and perspective sketching.

Technical Reporting II (1½ hrs/wk)

Research and writing of job procedures as they apply to preventive maintenance.

United States Steel

MOBILE EQUIPMENT REPAIR PROGRAM
Phase IV (4 weeks)

Air Compressors I (2 hrs/wk)

Single stage and two stage compressors, intercollers, aftercoolers, control methods, compressor types and troubleshooting.

Automotive Electrical II (3 hrs/wk)

Starters, generators, alternators, lighting systems, and voltage regulators. Electrical system troubleshooting.

Automotive Brakes I (3 hrs/wk)

Construction and operation of brake systems. Air brake principles and troubleshooting.

Automotive Engines I (4½ hrs/wk)

Engine valves, bearings, and pistons.

Electricity II (1½ hrs/wk)

Basic A.C. theory and circuits

Fabrication Layout I (4 hrs/wk)

Use of proper tools and techniques for transferring information from drawins to materials.

Hydraulics IV (5 hrs/wk)

Pressure control valves, pilot operated valves pumps, motors and coolers.

Lubrication I (2 hrs/wk)

Types, properties and theory of lubricants. Lubrication systems.

Math IV (4 hrs/wk)

Advanced and regular sections of trigonometry.

Mechanisms IV (4 hrs/wk)

Cams, power transmission, mechnical drives and linkage.

Pneumatics I (3 hrs/wk)

Boyles law, valves, motors and system characteristics.

Shop Practices IV (4 hrs/wk)

Oxyacetylene welding and cutting.

United States Steel

MOBILE EQUIPMENT REPAIR

REGULAR MATH

Phase I

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00 – 9:00	D.C. CIRCUITS ET 118 Polesko	D.C. CIRCUITS ET 112 Polesko	MECHANISMS ET 115 Fenton	D.C. CIRCUITS ET 112 Polesko	MATERIALS ET 112 Fenton
10:00 – 11:00	SHOP PRACTICES ET 105 Leonard	MATH PS 104 Filipiak	SCHEMATICS ET 106 Essex	MATH PS 104 Filipiak	D.C. CIRCUITS ET 110 Polesko
11:00 – 12:30	MATH PS 114 Filipiak	SAFETY PS 108	MATH PS 114 Filipiak	MATERIALS ET 113 Fenton	HYDRAULICS ET 108 Ramsdell
12:30 – 1:00	L U N C H				
1:00 – 2:00	RIGGING ET 108 Kaye	SHOP PRACTICES ET 113 Leonard	TECH. REPORT ET 106 Ramsdell	SCHEMATICS ET 111 Essex	RIGGING ET 115 Kaye
2:00 – 3:00				HYDRAULICS ET 108	
3:00 – 4:30	AUTO. SUSP. ET 116 Kisseberth	PHYSICS ET 115 Bidwell	HYDRAULICS ET 108 Ramsdell	Ramsdell	PHYSICS PS 114 Bidwell

United States Steel

MILLWRIGHT PROGRAM
Phase I (4 weeks)

Blueprint Reading I (2 hrs/wk)

Alphabet of lines, orthographic drawings, dimensions, and notes.

Couplings (3 hrs/wk)

Procedures for replacing and properly aligning couplings.

Hydraulics I (5 hrs/wk)

Basics of fluid power, hydraulic fluids, power units, storage reservoirs, and power lines.

Industrial Safety (1½ hrs/wk)

Guest speakers from U.S. Steel present topical safety programs.

Materials I (3½ hrs/wk)

Crystalline structure of metals. Definition and measurement of properties. Steelmaking processes.

Math I (5 hrs/wk)

Advanced and regular sections of arithmetic and metrics.

Mechanisms I (3 hrs/wk)

Belts and Pulleys.

Physics I (3 hrs/wk)

Fundamentals. Solids, liquids, and gases; forces, balance, and gravitation.

Rigging I (4 hrs/wk)

Ropes, chains, hooks, and slings. Theory of knots, scaffolds. Accident prevention.

Shop Practices I (3 hrs/wk)

Use and care of hand tools.

Shop Sketching I (4 hrs/wk)

Sketching straight and curved lines, irregular shapes, and fillets. Freehand lettering. Orthographic sketching.

Technical Reporting I (3 hrs/wk)

Basic oral and written communications.

United States Steel

MILLWRIGHT PROGRAM
Phase II (4 weeks)

Blueprint Reading II (2 hrs/wk)

Tolerances, screw threads, tapers, finishes, and notes. Sections. Metric and international systems. Bills of material.

Fasteners I (2 hrs/wk)

Types, specifications, and uses.

Hydraulics II (5 hrs/wk)

Control of hydraulic energy, actuators, check valves, accumulators, and cylinders.

Industrial Safety (1½ hrs/wk)

Guest speakers from U.S. Steel present topical safety programs.

Materials II (3½ hrs/wk)

Characteristics of irons and steels, forces in steel structures, and forces in joints.

Math II (5 hrs/wk)

Advanced and regular sections of algebra.

Mechanisms II (3 hrs/wk)

Chains and sprockets.

Physics II (3 hrs/wk)

Levers, inclined plane, wheel, and screw threads. Simple and compound gear trains and machines. Fluids at rest and in motion. Atmospheric pressure.

Rigging II (4 hrs/wk)

Life belts, ladders, cranes, hoists, and derricks. Load calculation. Handling loads on slings. Hoist signals. Jacks, rollers and skids. Timbers and metal beam load calculation.

Seals & Packing I (3 hrs/wk)

Materials, construction, installation and operation.

Shop Practices II (2½ hrs/wk)

Measurements, tolerances, and fits.

Shop Sketching II (4 hrs/wk)

Freehand lettering. Isometric, oblique and perspective sketching.

Technical Reporting II (1½ hrs/wk)

Research and writing of job procedures as they apply to preventive maintenance.

United States Steel

MILLWRIGHT PROGRAM
Phase III (4 weeks)

Bearings I (4 hrs/wk)

Types, applications and maintenance.

Blueprint Reading III (2 hrs/wk)

Use of construction and manufacturing drawings.

Electricity III (2½ hrs/wk)

Basic D.C. theory and circuits

Hydraulics III (5 hrs/wk)

Flow control and direction control valves. Hydraulic circuits.

Machine Erection I (2 hrs/wk)

Equipment moving, locating and leveling. Foundations, vibration dampers, grouting, and anchoring devices.

Math III (4½ hrs/wk)

Advanced and regular sections of geometry.

Materials III (1½ hrs/wk)

Non-ferrous metals and their alloys.

Mechanical Drawing I (4 hrs/wk)

Use of drafting tools, lettering and geometric constructions.

Mechanisms III (4 hrs/wk)

Gears and gear trains.

Pumps I (3 hrs/wk)

Centrifugal, reciprocating, rotary and special application pumps.

Shop Practices III (4 hrs/wk)

Material cutting and removal. Sanding, drilling, filing, sawing, grinding, and abrasives.

Structural Materials I (2½ hrs/wk)

American standard angles, beams, channels, tees, plates, and flat bar.

Trade Topics I (1 hr/wk)

Discussion of specific in-plant problems encountered by the apprentice millwright.

MILLWRIGHT PROGRAM
Phase IV (4 weeks)

Air Compressors I (2 hrs/wk)

Single-stage and two-stage compressors, intercoolers, aftercoolers, control methods, compresor types and troubleshooting.

Electricity II (1½ hrs/wk)

Basic A.C. theory and circuits.

Fabrication Layout I (4 hrs/wk)

Use of proper tools and techniques for transferring information from drawings to materials.

Hydraulics IV (5 hrs/wk)

Pressure control valves, pilot operated valves, pumps, motors, and coolers.

Lubrication I (2 hrs/wk)

Types, properties, and theory of lubricants. Lubrication systems.

Materials IV (2½ hrs/wk)

Properties of general maintenance materials such as cement, rubber, plastics, adhesives, wood, etc.

Math IV (4 hrs/wk)

Advanced and regular sections of trigonometry.

Mechanical Drawing II (4 hrs/wk)

Dimensioning, multiview projection, auxiliary views, multiview drawings.

Mechanisms IV (4 hrs/wk)

Cams, power transmission, mechanical drives and linkage.

Pneumatics I (3 hrs/wk)

Boyles Law, valves, motors, and system characteristics.

Pumps II (3 hrs/wk)

Pump control mechanisms and principles of their operation. Pump capacity, pressure and head. Pump maintenance.

Shop Practices IV (4 hrs/wk)

Ocacetylene welding and cutting.

Trade Topics II (1 hr/wk)

Discussion of specific in-plant problems encountered by the apprentice millwright.

LORAIN TELEPHONE CO.

FALL QUARTER

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00 – 9:00			Blueprint Reading ET 122		Math ST 103
10:00 – 11:00			Basic Electricity ET 118		Basic Electricity ET 110
12:30 – 1:00	L U N C H				
1:00 – 2:00			Basic Electricity ET 110		Basic Electricity ET 111
3:00 – 4:30			Math PS 103		Blueprint Reading ET 122

CURRICULUM

FOR LORAIN TELEPHONE CO.

PHASE I TRAINING

WEEK 1 (16 hours)

Electricity (9 hours)

1. Safety in the laboratory
2. Atomic theory
3. Electron theory
4. Theories of magnetism and electromagnetism
5. Voltage, current and resistance

Mathematics (3½ hours)

1. Review fundamentals of addition, subtraction, multiplication and division.
2. Addition and subtraction of fractions.

Print Reading (3½ hours)

1. Schematic symbols used in circuit diagrams.
2. Elementary circuit diagrams.

WEEK 2 (16 hours)

Electricity (9 hours)

1. Resistance and conductance
2. Ohms law.
3. Power losses and component rating.
4. D.C. measuring instruments.

Mathematics (3½ hours)

1. Multiplication and division of fractions.
2. Decimals and percentages.

Print Reading (3½ hours)

1. Types of prints used in the telephone company.
2. Conventional terminology used on drawings.

The Lorain Telepnone Co.

Phase I Training.

WEEK 3 (16 hours)

Electricity (9 hours)

1. Series circuits.
2. Parallel circuits.
3. Series-parallel circuits.
4. Kirchoff's Laws

Mathematics (3½ hours)

1. Metrics (SI)
2. Exponents, radicals and scientific notation.

Print Reading (3½ hours)

1. General information contained on drawings.
2. Reading telephone company construction drawings.

WEEK 4 (16 hours)

Electricity (9 hours)

1. Sources of direct and alternating current.
2. A.C. measuring instruments.
3. Resistive A.C. circuits
4. Inductance and inductive circuits.

Mathematics (3½ hours)

1. Signed numbers
2. Introduction to algebra.

Print Reading (3½ hours)

1. Reading construction drawings.
2. Reading equipment drawings.

The Lorain Telephone Co.

Phase I Training

WEEK 5 (16 hours)

Electricity (9 hours)

1. Transformers.
2. Capacitance and capacitive circuits.
3. RC, RL, and LCR circuits.

Mathematics (3½ hours)

1. Solution of simple equations.
2. Simple formulas and literal equations.

Print Reading (3½ hours)

1. Reading equipment drawings.
2. Using explanation sheets with drawings.

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